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Nutrient Return to Soil in the Santa Monica Mountains after Combustion

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Abstract

In this study, levels of phosphorus, nitrogen, and PH from eight uniform soil samples from the Santa Monica Mountain swere assessed. Our first testing group contained four uniform samples of soil, which were tested under regular drought conditions. Our second testing group contained four identical samples, which we tested under regular drought conditions and also exposed to fire. Our hypothesis was that soil after wildfire will have different amounts of phosphorous, nitrogen, and Ph. Our research found that average phosphorus uptake in unburned samples vs. burned samples were significantly different at a P<0.0001. Nitrogen and pH levels however, were not found significantly different between burned and unburned samples.

Introduction

Fire and drought are a few of the many concerns in the Santa Monica Mountains. The Santa Monica Mountains are very prone to wildfires that ignite due to human activities. These fires have become more frequent over the years with an average fire interval of about every 8 years. Fires occur very frequently so we decided to perform a study about nutrient return into the soil post combustion. We hypothesized that levels of phosphorus, nitrogen, and pH will differ after a wildfire versus no wildfire.

In order to test this hypothesis, we gathered eight uniform samples of soil and eight uniform samples of Malosma laurina leaves to be tested in two separate groups. Our first testing group we labeled unburned, which represented our control group. Our second testing group we labeled burned, which was exposed to fire, in addition to the standard drought conditions in the Santa Monica Mountains of Southern California.

We used tin cans and filled them with 100 grams of soil and placed 5 grams of Molasmo laurina leaves in each tin can. We burned four out of the eight tin cans and left four unburned as our control group. We burned these four samples in a local barbeque on Pepperdine's main campus. Once completely burned, we retuned to the KECK lab to start our testing.

With a common soil kit, we were able to collect phosphorus, nitrogen, and pH measurements on both the four unburned samples and the four burned samples. We were able to graphically represent the data and could determine if there was any data that was significantly different

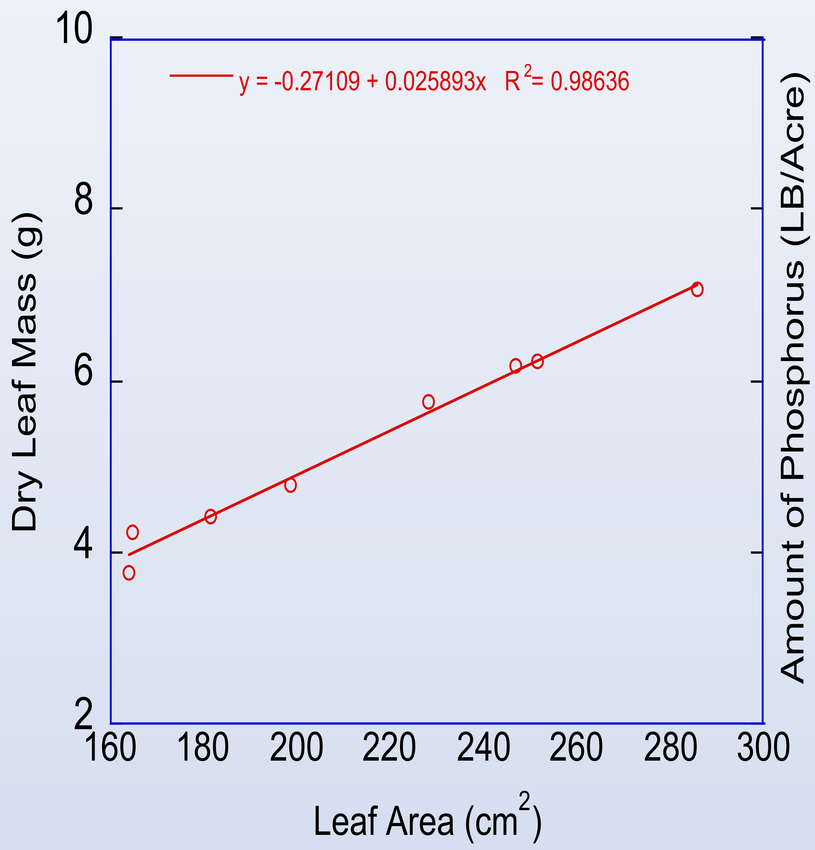


Figure 1: Relationship between dry leaf mass(g) and leaf area (cm^2) of *Malosma laurina* growing at the Dana Martel Trail located on Pepperdine University's Campus. Data was collected from eight leaf samples. The r^2 value of 0.98636 shows an extremely strong correlation between dry leaf mass and leaf area.

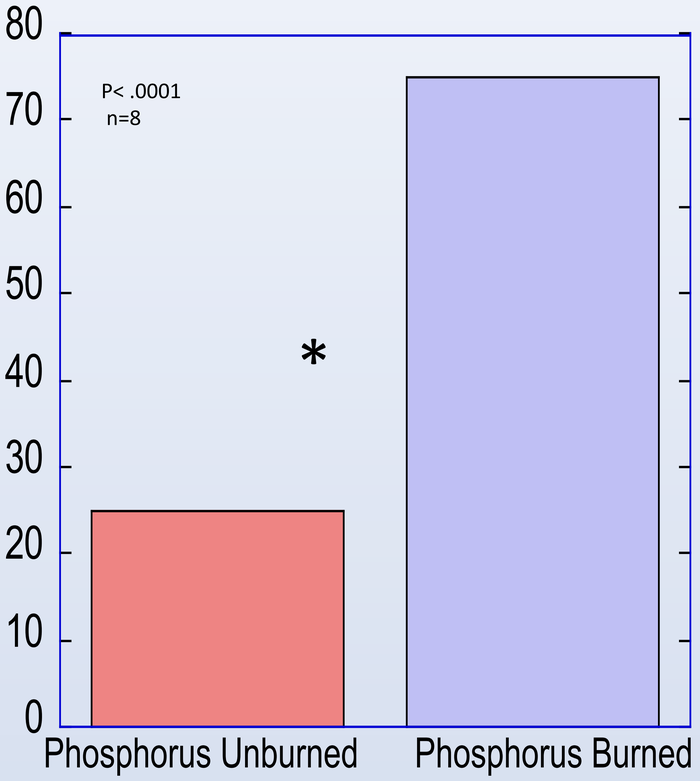
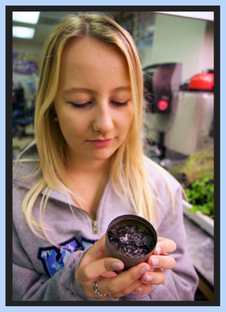


Figure 2: Phosphorus level's of unburned versus burned *Malosma laurina* growing at the Dana Martel Trail located on Pepperdine University's Campus. Data was collected from eight 100 gram samples of soil, four unburned and four burned. Phosphorus levels were recorded in lbs./acre. There is no variance between the two groups. An asterisk indicated significant difference by two-tailed, unpaired student's t-test, at P<0.0001.



Methods

We began collecting Malosma laurina leaves from the Dana Martel Trial located on Pepperdine's Malibu Campus. The leaves were randomly picked from several plants along the trail.

Upon returning to the lab, we measured the surface area of the leaves using the LICOR 3100. Next, we collected the mass of leaves before and after incubation.

After one week of being in the incubator, we prepared only five grams of crushed leaves to be topped onto the uniform soil samples. Our soil was collected from the land behind the greenhouse on Pepperdine's main campus where soil type varies and is restricted from any sprinkler system.

We randomly assigned samples to either "burned" or "unburned" and labeled them accordingly. Those which were labeled "burned" were then taken to the barbeque and lit on fire using a barbeque lighter. We used an infrared thermometer to record the average temperature of the flame used to burn each sample. Once the samples were completely burned, we returned to the KECK lab for soil kit testing. With the soil testing kit, we were able to collect the phosphorus, nitrogen, and pH levels of all eight samples. We recorded the data and analyzed the differences using KaleidaGraph software.

Discussion and Conclusion

The correlation between dry leaf mass and leaf area is extremely high with an r^2 value of 0.98636. This indicated that leaf mass and leaf area are interchangeable in our experiment.

Our results show that there is no significant difference between the pH and nitrogen levels of the burned and unburned samples. This shows that burning doesn't affect the pH level or the nitrogen level in *Malosma laurina* leaves. However, the phosphorous level is significantly different in the burned and unburned samples. The phosphorous level of the unburned samples is higher than the phosphorous level of the burned sample. This means that the temperature of the fire was so high during the burning that both phosphorous in the leaf and in the soil volatilize. Our project showed that burning will affect phosphorous levels but not pH or nitrogen levels.

Hypothesis

1. Our hypothesis that soil after wildfire would have different measure of phosphorous, nitrogen, and PH.

References

GARY, GEOFFREY J., and DAVID A. MORRISON. "Effects of fire frequency on plant species composition of sandstone communities in the Sydney region: Combinations of inter-fire intervals." Australian Journal of Ecology 20.3 (1995): 418-426.

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